

An Elderly Man With Fever and Cough

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A Patient-Oriented Problem-Solving (POPS) System

Elderly Man With Fever and Cough

Pretest

Instructions: Please mark your answers to the following questions on this exam to facilitate later discussion and review. If your instructor has provided a separate answer form, please be sure to fill in the identification section; then answer the questions both on the form and on this exam.

Choose the *one* correct or most appropriate answer. If you do not know an answer, leave it blank. Do not guess. Health professionals who think they know something, but don't, can do real harm. Those who *know* they don't know something can get help.

Don't be upset if you don't know all the answers. The purpose of the pretest and objectives is to alert you to important concepts. The posttest will be similar to the pretest.

1. The slide reproduces a nutrient agar plate seeded with an aerobic Gram negative rod recovered from the urine of a 78 year old man with advanced prostatic carcinoma in whom a Foley catheter was placed to relieve obstruction. Of the following antibiotics, which one would be more likely effective in this patient?
 - A. Doxycycline
 - B. Ceftriaxone
 - C. Sulfamethoxazole-trimethoprim
 - D. Metronidazole
 - E. Piperacillin/Tazobactam

2. Which of the following steps has been successfully used to increase the immunogenicity of the *Streptococcus pneumoniae* vaccine in humans?
 - A. Use of complete killed bacteria instead of polysaccharides
 - B. Conjugation of the bacterial polysaccharides with an immunogenic protein
 - C. Emulsion in Complete Freund's Adjuvant (CFA)
 - D. Increase the diversity of polysaccharides in the vaccine
 - E. Simultaneous injection with the Diphtheria-Tetanus-Pertussis (DTaP) vaccine

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3. A case of influenza is diagnosed in a nursing home. The remaining patients have not yet received the annual flu vaccine. What is the best strategy to reduce the probability of a flu outbreak in the nursing home?
- A. Administer Tamiflu immediately to everyone in the nursing home
 - B. Administer the flu vaccine immediately to all staff and residents
 - C. Hospitalize the patient and transfer the residents to another facility
 - D. Quarantine the patient in respiratory isolation
 - E. Treat the patient and close contacts with amantidine

Questions 4 and 5 refer to the following case:

A 73-year-old veteran who has smoked 1-2 packs of cigarettes/day since age 16 yr. is seen at the emergency room with cough, fever (104.2°F) of four days duration and diarrhea for the last two days. His past medical history includes chronic bronchitis for the last 20 years. A chest X-ray shows intensification of the interstitium in both lungs and an ill-defined consolidation area in the lower right lobe. A sputum sample is obtained and microscopic examination shows abundant leukocytes, including polymorphonuclear leukocytes and mononuclear cells. A Gram stain and an acid-fast stain of the sputum are negative. Blood cultures are negative.

4. Which of the following diagnoses should be thoroughly investigated in this patient?
- A. Legionnaire's disease
 - B. Pneumococcal pneumonia
 - C. *Pneumocystis carinii* pneumonia
 - D. Psittacosis
 - E. Viral pneumonia
5. The possibility of transbronchial biopsy is discussed with the patient but he refuses the procedure. Which of the following alternative diagnostic procedures should be considered as most indicated for this patient?
- A. Antigen detection in the urine
 - B. Assay of circulating antibodies
 - C. Bronchoalveolar lavage
 - D. Direct immunofluorescence using sputum or biopsy tissue
 - E. Sputum cultures

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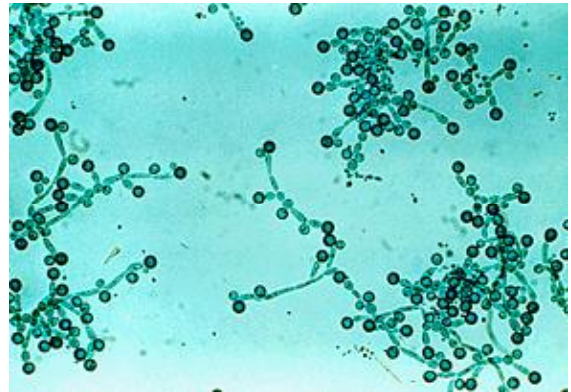
6. You routinely ask patients in your primary care practice whether they have considered what they would like physicians to do in the event they were incapacitated and required life support with little hope of recovery. Today, you saw Mr. W., a 75-yr-old married man, who was visibly uncomfortable dealing with this issue. Which of the following statements would be the most appropriate to continue the discussion?
- A. As difficult as it may seem, it is best for him to discuss end of life issues with his wife and family in advance so they may speak for him if he can't speak for himself
 - B. He must complete a Living Will since it is required by state law for all persons over age 75 years
 - C. Such decisions by patients should be easy to make since he has lived a full life to this point.
 - D. Without advance guidance by Mr. W, you as the physician will decide what is best for him in that situation.

Questions 7 and 8 refer to the following case:

7. An 80-year-old man was brought to the emergency room by his son who noted that the patient was getting progressively more lethargic and had decreased urination over the past 4 days. The patient was home bound and over the past week has remained in bed. Past medical history included several bouts of acute urinary tract obstruction and an enlarged prostate gland. On physical examination the patient had a temperature of 104°F (40°C), his blood pressure was 75/45 mmHg and he was difficult to arouse. Mucous membranes were dry and he had poor skin turgor. The urinary bladder was distended to the level of the umbilicus. The prostate was enlarged on rectal examination. A white blood count was 15,000/ μ L with 60% polymorphonuclear cells and 20% bands. Which of the following is the major indication that this patient requires immediate initiation of therapy?
- A. Deterioration of his mental status
 - B. Possible malignant nature of his prostatic enlargement
 - C. Possible urinary tract infection
 - D. Signs and symptoms suggestive of bacteremia and likely sepsis
 - E. Signs and symptoms suggestive of dehydration
8. What is the most likely cause for this patient's fever?
- A. A direct effect of endotoxin on the hypothalamic temperature regulation center
 - B. An increased blood supply to the hypothalamus caused by vasoactive mediators
 - C. The generation of pyrogenic complement fragments by macrophage proteases
 - D. The release of C-reactive protein by the liver
 - E. The release of TNF α , IL-1 β and IL-6 by activated macrophages

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9. A 66 yr. old man receiving chemotherapy for metastatic prostate carcinoma develops persistent fever not affected by administration of broad-spectrum antibiotics. A CBC and differential reveals profound neutropenia and a white exudate, resembling a cotton wool ball, is seen in the vitreous of the right eye. The organism shown in the figure was grown from the peripheral blood in Sabouraud's agar. What is the most likely source of this organism?
- A. air conditioning vents
 - B. endogenous flora
 - C. hands of health care workers
 - D. hospital food
 - E. shower heads



10. An 80-year-old married man on Medicare with arthritis and mild dementia has a Staphylococcal impetigo on his arm that has not responded to topical antibiotics. Which of the following steps is more likely to help maximize his adherence to a regimen of oral antibiotics?
- A. Choose a three times a day rather than a twice a day antibiotic regimen
 - B. Choose the most recently introduced anti-staphylococcal antibiotic
 - C. Minimize the fact that many patients have nausea and diarrhea while taking the antibiotic
 - D. Verbally explain to him and his wife the expected complications without treatment

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BOOK 1

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A Patient-Oriented Problem-Solving (POPS) System

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Introduction to the Patient-Oriented Problem-Solving (POPS) System

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Elderly Man With Fever and Cough

Introduction to the case

This POPS clinical simulation deals with the special problems related to infections in a geriatric patient. Old, debilitated patients tend to develop more severe disease when infected by pathogenic organisms and are more susceptible to opportunistic and nosocomial infections. Drug toxicity and drug interaction issues are also very significant in older patients, who often have pre-existing conditions that interfere with drug metabolism and often take multiple medications which have the potential of interacting in adverse ways. Finally, infections in the elderly population can get complicated and lead to situations in which decisions concerning life support need to be taken by the immediate family, raising ethical and legal questions.

When you have completed this activity you should be able to

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- 10) Discuss how decisions concerning termination of life support measures should be reached and what are the ethical principles governing such decisions.

When you **have become familiar with the objectives, complete the pretest on the next page.**

Elderly Man With Fever and Cough

Pretest Correct Answers

You have the answers to some of the ten pretest questions, and other members of your group have the remainder. This arrangement is designed to encourage all members of your group to actively exchange ideas and concepts. First, study the answers in your booklet and then EXPLAIN them to your group. Please don't just read them to your classmates, and don't let your classmates read their answers to you. In explaining something to another person, most people gain a better understanding of it and often transmit a better understanding. *The pretest discussion and patient-oriented problem-solving parts of this activity are "open book."* Be sure to refer to textbooks, notes, and other written resources whenever questions arise.

You will probably want to make notes on your pretest to help you review questions that you missed. Avoid "collecting pages" for "later study and understanding." Learn the concepts now so that later you will only need to review them.

1. The answer is E. A Gram-negative rod that releases a green diffusible pigment in culture is most likely one of the *Pseudomonas aeruginosa* and related species. Pseudomonas are often resistant to multiple antibiotics. Piperacillin, a semi-synthetic penicillin, was introduced as particularly effective against Pseudomonas. Its use with a beta-lactamase inhibitor (Tazobactam) increases its potential value as an empiric agent to use in the treatment of Pseudomonas infections.
6. The answer is A. As a primary care physician, you should provide to your Mr. W the facts about chances of recovery with end of life interventions such as CPR, dialysis, antibiotics, and mechanical ventilation, and he should be advised that many interventions may only prolong suffering and the dying process. Since his wife and children will be participating in decision-making when he is incapable, advance discussion between all of them about such end of life issues usually serves to alleviate some of the family's stress and to clarify goals of treatment for him.

When your group has finished discussing the pretest, you should read the "Instructions for the Clinical Problem" on the next page of your booklet.

Elderly Man With Fever and Cough

Instructions for the Clinical Problem

Infections in the elderly are a significant cause of morbidity and mortality with increasing prevalence due to the increase in our elderly population. Treating the elderly requires awareness of special age-related issues that may complicate the outcome of our interventions. The purpose of this exercise is to introduce you to some of these issues, including the most difficult decisions that may emerge when an infection proves to be resistant to therapy and leads to a situation in which the patient is only able to survive with artificial life support measures.

Each of the four group members has different sections of a case history. First, deal with your own section. After sharing the information given to each one of you by the prescribed order, decide the next steps you would take, discuss the reasons for your choice(s) - group members who disagree with a given choice, the reasons for it, or consequences of it should present their ideas and defend them. The final group answers should be recorded in the handouts. After you reach the end of the case you should revisit it and make sure that all the answers make sense and that no one in the group is left with unanswered questions or misconceptions.

Remember, this is an "open-book" activity, and you should consult your textbooks about any point you don't understand.

Elderly Man With Fever and Cough

Mr. B's initial respiratory infection

Mr. B., a 77 year-old man with type II diabetes, came to visit his wife, who suffers from advanced Alzheimer's disease, at the Golden Homes (a retirement and assisted living facility) to celebrate Thanksgiving. Although his wife seemed not to recognize him and was unable to participate in the festivities, he had dinner with a large group of residents and guests with whom he interacted.

He started complaining of feeling achy and febrile the following day. His physician requested rapid testing for Influenza A that came back negative. He got progressively worse, complaining of a productive cough with purulent sputum, dyspnea, and high fever. He was sent to the emergency room. PE showed a well-nourished man in mild respiratory distress, temperature 102°F (38.9°C), respiratory rate 28/min, blood pressure 142/80 mm Hg. Lung exam revealed bronchial breath sounds and rales in the right mid-lung field. The following X-ray was obtained:

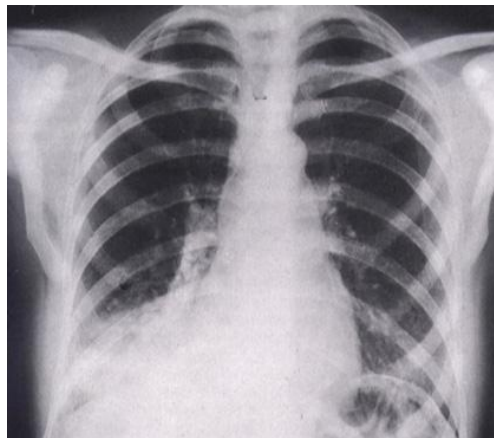


Figure 1

Past medical history included type II diabetes with 20 years of evolution and chronic renal insufficiency secondary to diabetic nephropathy. His last determinations of blood urea nitrogen (BUN) and serum creatinine were of 34 mg/dL and 1.8. mg/dL, respectively. Blood glucose was 279 mg/dL and HbA_{1c} was 7.9%.

Elderly Man With Fever and Cough

Which of the following tests would you like to order for this patient? Why?

☐ Blood cultures

☐ Arterial blood gases

☐ Bronchoalveolar lavage, silver stain for *Pneumocystis carinii*, immunofluorescence for *Legionella*

☐ CBC and differential

☐ CT scan of the chest

☐ Respiratory virus serologies

☐ Sputum Gram stain and culture

☐ Throat swab and culture

☐ Urinalysis

Elderly Man With Fever and Cough

Results

CBC and differential

Hemoglobin; 14.2 g/L; WBC: 16,000 mm³; Lymphocytes: 10%; monocytes: 7%; neutrophils 70%; bands: 10%; basophils: 2%; eosinophils: 1%

Sputum Gram stain and culture

The Gram stain is reproduced below. Cultures are pending.

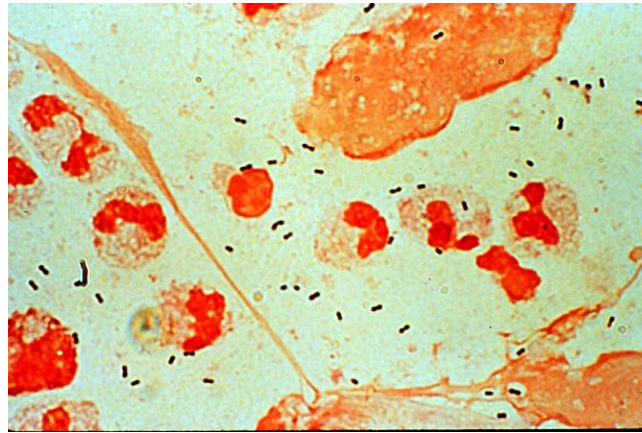


Figure 2

Bronchoalveolar lavage, silver stain for PCP, IF for *Legionella*

Not approved by the pulmonologist.

Blood cultures

□ □ □ □ □ □ □

Viral cultures of bronchial aspirate

Pending

Urinalysis:

Glucose ++; protein +; leukocyte esterase: negative; no bacteria seen on Gram stain of the sediment

Blood gases

Oxygen saturation: 90%

Respiratory virus serologies

Pending

Throat swab:

Polybacterial flora

CT scan of the chest:

Pending

Elderly Man With Fever and Cough

The patient needs to be treated. While the cultures are pending which of the following antimicrobials would you order?

☐ Amoxicillin

☐ Azithromycin

☐ Ceftriaxone

☐ Levofloxacin

☐ Oseltamivir (Tamiflu)

☐ Ribavirin

☐ Vancomycin

Infections in the Elderly

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Elderly Man With Fever and Cough

Pretest Correct Answers

4. The answer is A. There are numerous elements in this case suggestive of this diagnosis: the age of the patient, his smoking habits and chronic bronchitis, the bilateral nature with ill-defined consolidation of his pneumonic process, the lack of visualization of bacteria in sputum, and the presence of diarrhea. The association of pneumonia and diarrhea is highly suggestive of Legionellosis. The negative results in routine cultures are to be expected, because *Legionella* are fastidious organisms that grow well only in specialized media, such as Charcoal Yeast Extract supplemented with cysteine.
5. The answer is A. Although transbronchial biopsy would be an adequate method to obtain adequate samples for bacteriological studies in this patient, an invasive procedure in an elderly and debilitated subject should always be very carefully considered. Recent studies have shown that antigen detection in the urine is a rapid and specific assay for the diagnosis of Legionellosis, with the advantage of being a totally non-invasive technique.
10. The answer is D. Compliance with drug regimens is usually enhanced by simplifying the regimen as much as possible, and balancing effectiveness with the side effect profile of the drug. The newest antibiotics, while often appealing because of effective marketing, are almost always more expensive and may not be covered by all insurance plans. Informing your patient or their surrogate about possible side effects and potential complications without therapy in advance gives them an opportunity to tell you any reluctance to follow through with your instructions.

Elderly Man With Fever and Cough

Case Evolution Part 1

The patient was started on Vancomycin. Forty-eight hours later the following results become available:

Sputum culture

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ *for Streptococcus pneumoniae, susceptible to penicillin. vancomycin and ceftriaxone.*

Blood cultures

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ *for Streptococcus pneumoniae, susceptible to penicillin. vancomycin and ceftriaxone.*

CT scan of the chest:

Cancelled

Respiratory virus serologies

Negative

Elderly Man With Fever and Cough

Evolution ctd.

In the two days following the initiation of antibiotic therapy the patient shows improvement and becomes afebrile. His cough becomes less intense, and his respiratory rate slows down. A WBC count is $9 \times 10^3/\text{mm}^3$

On day 3 his urinary output decreases and serum creatinine is 2.3 mg/dL. Blood glucose is 265 mg/dL

At this time you should investigate (justify):

☐ Deterioration of diabetic nephropathy

☐ Drug-induced nephrotoxicity

☐ Hypovolemia

☐ Post-infectious glomerulonephritis

☐ Urinary tract infection

Elderly Man With Fever and Cough

Evolution ctd.

On day 5 a new set of blood cultures is negative and a urine culture is negative. However, serum creatinine increases to 3.1 mg/dL. At this time vancomycin is stopped and replaced by penicillin G. Comparison of fluid intake and urinary output showed that the patient was adequately hydrated. Orthostatic hypotension is not detected. Because of progressive decrease in urinary output a Foley catheter is inserted in the bladder. After two days serum creatinine stabilized at 3.0 mg/dL and the urinary output continues to be low. The temperature increased to 38.3°C (100.4°F). Three days after placing the catheter the urine collected through the catheter became cloudy.

At this time you should order (justify):

☐ Blood cultures

☐ Blood leukocyte count

☐ Urine analysis including sediment

☐ Urine culture

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Pretest Correct Answers

2. The answer is B. Polysaccharide vaccines are not as immunogenic as protein vaccines because polysaccharides do not elicit T lymphocyte help. However, if a polysaccharide is conjugated to an immunogenic protein (such as a bacterial toxoid) the response to the polysaccharide is enhanced, IgG antibodies are produced, and immunological memory is generated. The use of whole killed bacteria has no advantage over the use of polysaccharides. Complete Freund's Adjuvant is very effective but induces strong inflammatory reactions and is not used for human immunization. An increase in the number of polysaccharides represented in the different vaccines is problematic because of volume considerations. Finally, simultaneous administration of the pneumococcal vaccine with the DTaP vaccine would only make sense in the pediatric population.
3. The answer is A. Given the very short incubation period of the flu (1-3 days) there is no time to vaccinate, even to induce a secondary response that would protect the exposed individuals. The only measure that may prevent the disease from emerging or reduce its severity is the immediate administration of antiviral agents active against the flu virus. Tamiflu is a recently introduced neuraminidase inhibitor that interferes with viral replication and is very effective if given before the disease is manifest or very early after symptoms have appeared. Amantidine is another effective antiviral drug used against the Influenza virus (blocks penetration and/or uncoating of the virus). However, the administration of antivirals should not be limited to the patient and close contacts, but rather to every patient and health care worker in the facility.
9. The answer is B. *Candida albicans* is commonly an element of the endogenous gastrointestinal flora. In debilitated patients, and particularly those who are neutropenic, the organism may become a pathogen and, on gaining access to the circulation, seed various organs. Disseminated candidiasis may be suspected based on ophthalmoscopic exam by the finding of focal, white, infiltrative chorioretinal lesions without vitreal involvement or by the finding of lesions suggestive of candida endophthalmitis (chorioretinitis with extension into the vitreous) or intravitreal "cotton-wool ball" lesions.

Elderly Man With Fever and Cough

Case Evolution Part 2

The following results become available:

Urinalysis: *leukocytes*: ++; *bacteria*: ++++; *leukocyte esterase*: positive

Urine culture:

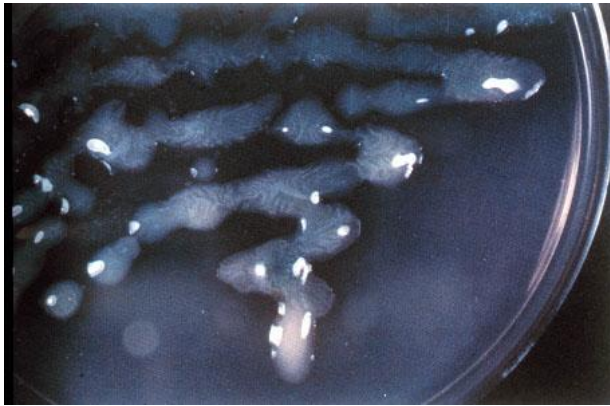


Figure 3 - McConkey's agar

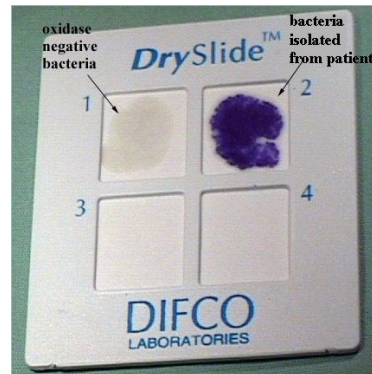


Figure 4 - Oxidase test

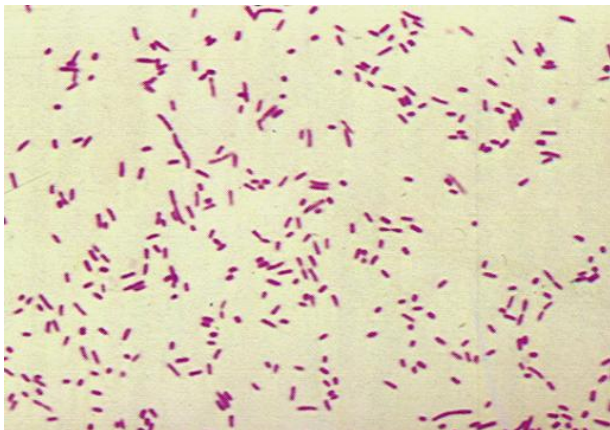


Figure 5 - Gram stain of organisms in culture

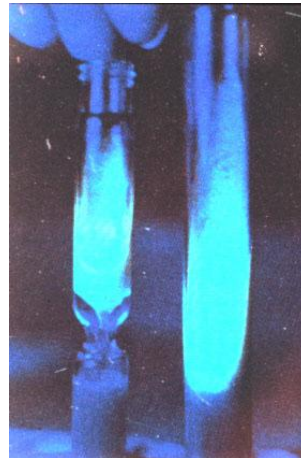


Figure 6 - Fluorescence test

Elderly Man With Fever and Cough

What is the most likely cause of this patient's urinary tract infection?

What criteria would you follow to choose the proper antibiotic(s) to treat this patient?

Elderly Man With Fever and Cough

Evolution (2) ctd.

The organism recovered from the urine is identified as *Pseudomonas aeruginosa* resistant to cephalosporins, vancomycin, and susceptible to aminoglycosides, fluoroquinolones and to Piperacillin/tazobactam. The use of aminoglycosides is ruled out because of the potentially serious side-effects associated with their use. The patient receives Levofloxacin i.v., but fails to improve. He still has daily fever spikes. Blood cultures are reported as positive for *Pseudomonas aeruginosa*. The patient is switched to Piperacillin/Tazobactam (Zosyn) but continues to deteriorate. His blood creatinine jumps to 4 mg/dL, blood pressure drops to 80/50 mmHg, and he becomes anuric.

What is your assessment of the patient's condition at this time?

What is your interpretation of the sequence of events that culminated in the current situation?

Infections in the Elderly

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BOOK 4

The reason the POPS system works so well is that they have been revised many times based on feedback from students and faculty.

Please send suggestions and/or comments to: mcuchens@microbio.umsmed.edu

Note to Instructors

This workbook is divided into five sections:

1. Introduction to the POPS System, introduction to and objectives of the clinical simulation, and a pretest
18. Four booklets with pretest answers and the clinical problem(s)
19. Group question and answer sheets
20. Posttest
21. Posttest answers

Each student should receive a copy of section 1 to study and answer questions before the group problem-solving session. If you wish, section 2 also may be distributed for the students to review prior to the group session.

A Patient-Oriented Problem-Solving (POPS) System

Elderly Man With Fever and Cough

Introduction to the Patient-Oriented Problem-Solving (POPS) System

This is a Patient-Oriented Problem-Solving activity. The purposes are

1. To help you learn how to apply your basic science knowledge to the solution of clinical problems
2. To help you learn how to better use sources (i.e., textbooks and peers) that will be available to you throughout your career
3. To help you work with your fellow students and thus
 - a. increase your ability to evaluate your colleagues' opinions, thought processes, and diagnoses
 - b. increase communications skills
 - c. get to know your classmates better

This activity consists of four phases. First, you will review the attached set of objectives, do background reading on the topics to be covered, and complete the pretest on your own. In the second phase, you will join three other students and review the pretest answers in an "open-book" discussion. In the third phase, the group will solve patient-oriented problems. Information exchange and group interaction are keys to the success of this phase. This process will allow you to teach your fellow students and, at the same time, learn from them. Finally, you will take a posttest, individually, which will enable you to assess your progress.

Elderly Man With Fever and Cough

Introduction to the case

This POPS clinical simulation deals with the special problems related to infections in a geriatric patient. Old, debilitated patients tend to develop more severe disease when infected by pathogenic organisms and are more susceptible to opportunistic and nosocomial infections. Drug toxicity and drug interaction issues are also very significant in older patients, who often have pre-existing conditions that interfere with drug metabolism and often take multiple medications which have the potential of interacting in adverse ways. Finally, infections in the elderly population can get complicated and lead to situations in which decisions concerning life support need to be taken by the immediate family, raising ethical and legal questions.

When you have completed this activity you should be able to

- 1) List microbial agents that are frequently involved in respiratory tract infections in the elderly.
- 2) Discuss prevention measures that can be taken to minimize the occurrence of respiratory infections in the elderly
- 3) Discuss the rational approach to follow when deciding about empiric therapy for a community acquired bacterial pneumonia in an elderly patient.
- 4) List nephrotoxic antimicrobials .
- 5) Discuss the relationship between bladder catheterization and nosocomial infection.
- 6) List the **laboratory diagnosis** of infections caused by *Streptococcus pneumoniae*, *Pseudomonas aeruginosa*, and the influenza virus.
- 7) Discuss the mechanisms of antibiotic resistance for *Streptococcus pneumoniae* and *Pseudomonas aeruginosa*.
- 8) Select the appropriate **treatment and prophylaxis** for viral influenza, pneumococcal pneumonia, and Pseudomonas infections.
- 9) Discuss the pathogenesis of septic shock
- 10) Discuss how decisions concerning termination of life support measures should be reached and what are the ethical principles governing such decisions.

When you **have become familiar with the objectives, complete the pretest on the next page.**

Elderly Man With Fever and Cough

Pretest Correct Answers

7. The answer is D. This patient has an enlarged prostate gland that has caused urinary retention, probably urinary infection, and a likely septicemic infection (fever, lethargy, dehydration, leukocytosis with neutrophilia, and hypotension allow a preliminary diagnosis of septic shock). All these processes are a cause of concern, but from the immediate treatment point of view, septic shock needs to be immediately addressed. Samples should be obtained for culture followed immediately by measures aimed at correcting the circulatory collapse and systemic administration of broad spectrum antibiotics.

8. The answer is E. In a patient with a presumable bacterial infection, the most likely cause of fever is the release of pro-inflammatory cytokines by activated phagocytic cells and APCs, particularly the macrophages. The effect of endotoxin is mediated by macrophage activation and cytokine release. Changes in blood supply to the hypothalamus have no known effect on temperature regulation. Complement fragments and C-reactive protein are not directly pyrogenic.

Elderly Man With Fever and Cough

Case Evolution Part 3

The patient becomes comatose and continues to spike fevers despite broad-spectrum antibiotic therapy. Over the next three days he develops progressive heart failure and respiratory distress and remains anuric despite optimal therapy. He now will need a ventilator to maintain proper ventilation but last year he signed a Living Will stating that he would not want cardiopulmonary resuscitation or mechanical ventilation if he was dying. He has two adult children. One daughter lives in Charleston and has helped the patient after her mother became incapacitated. She would prefer that the wishes of her father be respected, but her older brother, who lives in Boston and came to see his father when he heard that his condition had deteriorated, wishes that he be kept alive using the ventilator and other life support treatments. What course of action would you advise now? Justify your choice(s):

☐ Respect the decision of the patient's older son

☐ Take immediate measures to withhold life-sustaining treatment and ensure a comfortable death in accordance with the living will

☐ Maintain the patient on life support

☐ Arrange a meeting with the patient's son and daughter to discuss prognosis and end of life issues

☐ Ask the ethics committee to make the treatment decisions

Elderly Man With Fever and Cough

Epilogue

After further discussion, the son, daughter and clinicians agree to withhold life-sustaining treatments and to optimize palliative care. The patient dies comfortably the following day with his children at his bedside.

Questions

What preventive step(s) could have decreased the risk for this patient's initial disease?

Were any therapeutic interventions ill advised in this patient?

How can the age and previous health problems of a patient affect the efficiency and/or adverse effects of antibiotic therapy?

Were all possible precautions that could have avoided the poor outcome of this case taken?

Elderly Man With Fever and Cough

Color plates

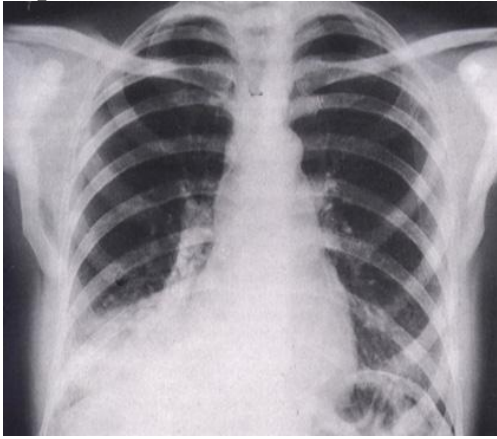


Figure 1

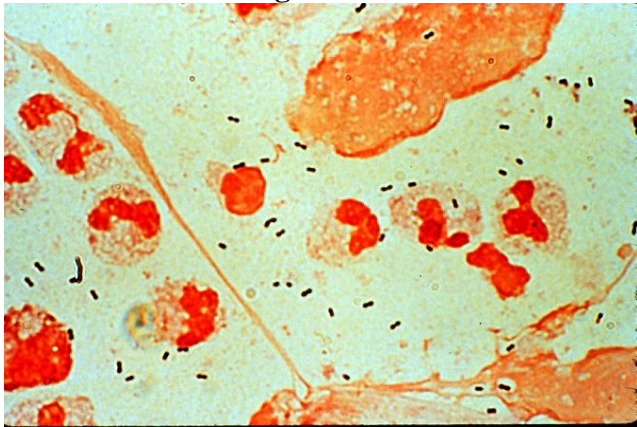


Figure 2 – Gram stain

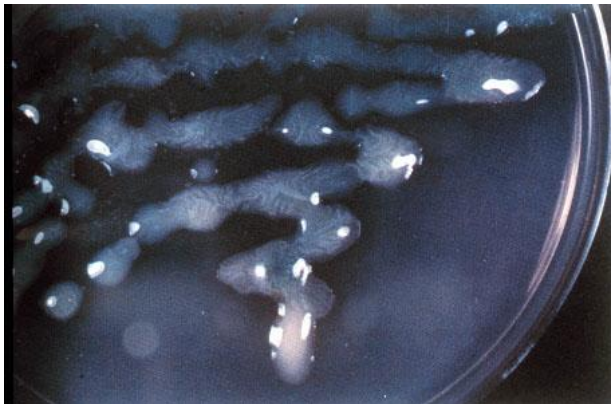


Figure 3 - McConkey's agar

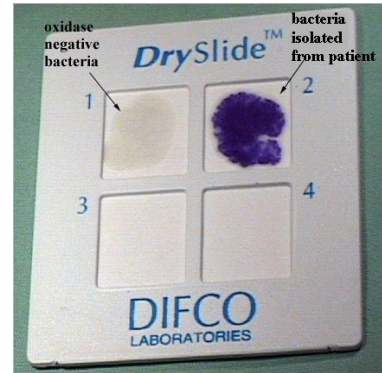


Figure 4 - Oxidase test

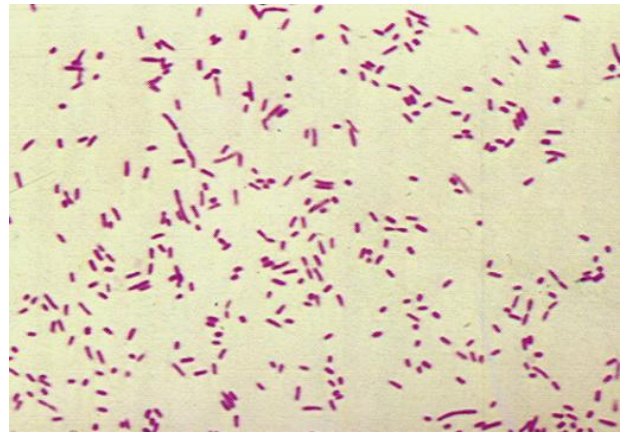


Figure 5 - Gram stain of organisms in culture

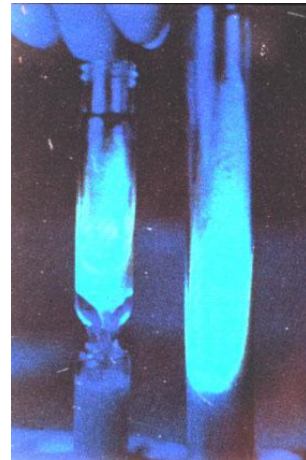


Figure 6 - Fluorescence test

Elderly Man With Fever and Cough

Post-Test

1. A 75-year-old widow living in a rural area comes to your office because she has had several colds last winter and is worried about her ability to fight disease. In discussing possible beneficial immunizations, which one of the following vaccines would be of least benefit for this patient?
 - A. Anthrax
 - B. Influenza
 - C. Pneumococcal
 - D. Tetanus
2. Which of the following clinical manifestations of *Streptococcus pneumoniae* is most frequently involved as a cause of morbidity and mortality in an older adult?
 - A. Endocarditis
 - B. Meningitis
 - C. Otitis media
 - D. Pneumonia
 - E. Septic shock
3. An 80 year-old man who attends a Senior Day Care facility develops malaise, low grade fever, diffuse aches, and a dry cough. His physician diagnoses Influenza B. To prevent an outbreak, employees and other seniors at his Day Care facility should receive a drug of which of the following classes?
 - A. DNA polymerase inhibitor
 - B. Neuraminidase inhibitor
 - C. Protease inhibitor
 - D. Reverse transcriptase inhibitor
 - E. Target-activated nucleoside analog

Questions 4 to 6 refer to the following case:

A 66-year-old male, is seen in the emergency room complaining of chest pain of sudden onset, cough productive of purulent and blood-tinged sputum, and fever, which rose abruptly after he had felt a sharp chill. Lab tests show a normal hematocrit, 20,000 WBC with 65% neutrophils and 10% bands. An X-ray of the thorax shows a consolidating pneumonia of the right middle lobe.

4. Which would be the most likely etiologic agent for this patient's pneumonia?
 - A. A combination of anaerobes
 - B. *Klebsiella pneumoniae*
 - C. *Mycoplasma pneumoniae*
 - D. *Pneumocystis carinii*
 - E. *Streptococcus pneumoniae*

Elderly Man With Fever and Cough

Post-Test (ctd)

5. What would be the antibiotic of choice to start this patient while the cultures are pending?
 - A. Ampicillin
 - B. Levofloxacin
 - C. Penicillin G
 - D. Sulfamethoxazole-trimethoprim
 - E. Vancomycin
6. Sputum cultures were negative. What other cultures should have been ordered to confirm this patient's diagnosis?
 - A. Blood
 - B. Broncho-alveolar lavage
 - C. CSF
 - D. Gastric aspirate
 - E. Urine

Questions 7 and 8 refer to the following case:

You are following an 84-year-old man that suffered a severe stroke that resulted in aphasia and paraplegia. The patient was breathing on his own but needed to be tube fed. Three months later he developed decubitus ulcers. Two weeks later he developed bilateral pneumonia and required assisted ventilation. The situation remained stable for the next week. You have informed the immediate family members of the dismal prognosis for the patient. The family notes that their loved one had told them in past conversations that he 'wouldn't want to live like this' and they request that he be taken off the ventilator and if he stops breathing, he not be resuscitated.

7. Which ethical principle or value best empowers the family members to make such decisions?
 - A. Autonomy
 - B. Distributive justice
 - C. Professional Integrity
 - D. Veracity
8. The patient resumed unassisted breathing when the ventilator was disconnected and was discharged. A week later, the patient has a respiratory arrest at home and the caretaker panics and calls EMS. EMS intubates and ventilates the patient and brings him to your intensive care unit. The immediate family explains that they did not want this situation to occur. They request that the patient be removed from life support. What is the most accurate of the following statements about withdrawal of life sustaining treatment in this case?
 - A. Decision-making based on weighing benefits and burdens is supportive of discontinuation of life support
 - B. Removal of life support is prohibited by law
 - C. The decision to remove life support is easier to make than the decision to withhold it
 - D. The removal of life support now will be active euthanasia

Elderly Man With Fever and Cough

Post-Test (ctd)

Questions 9 and 10 refer to the following case:

A 75-year-old woman is re-admitted to an hospital with general complaints of fever (39°C), malaise, anorexia, and flank pain. She had been released from the hospital about three days prior to this re-admission, after gallbladder removal. A Foley catheter had been inserted during her last admission and review of her records showed that she had fever 24 hours after surgery. She was treated with ampicillin. A urine specimen was obtained through the catheter and was found to contain pus cells and granular casts. A urine culture yielded colonies of an oxidase positive organism producing a green diffusible pigment.

9. Which of the following organisms is most likely to be present on this patient's urine?
 - A. *Escherichia coli*
 - B. *Klebsiella pneumoniae*
 - C. *Proteus mirabilis*
 - D. *Pseudomonas aeruginosa*
 - E. *Streptococcus viridans*

10. The antibiogram shows the isolated strain to be resistant to beta-lactam antibiotics and susceptible to fluoroquinolones, vancomycin, aminoglycosides, and chloramphenicol. Which of the following antibiotics would you prescribe to this patient?
 - A. Chloramphenicol
 - B. Gentamycin
 - C. Levofloxacin
 - D. Piperacillin
 - E. Vancomycin

Elderly Man With Fever and Cough

Answers to the Post-Test

1. The answer is A. Influenza and Pneumococcal vaccines are recommended for the geriatric population in general. An older female living in a rural area is part of the segment of the general population at a highest risk for tetanus, and should be immunized as well. Anthrax is not seen in rural areas of the USA, due to herd immunization, and the vaccine could represent a bigger risk to the health of this patient than the disease it protects against.
2. The answer is D. *Streptococcus pneumoniae* is also the most frequent cause of bacterial meningitis in adults, but the frequency of meningitis is considerably lower than the frequency of pneumonia in individuals of that age group. Septic shock may develop in older patients with pneumococcal pneumonia, particularly patients with diabetes or receiving treatment with immunosuppressive drugs.
3. The answer is B. The patient has viral influenza caused by the Influenza B virus. Influenza B virus, like the influenza A and C viruses, has a lipid bilayer envelope with inserted hemagglutinin and neuraminidase glycoprotein spikes that project to the outside. Zanamavir (Relenza) and oseltamivir (Tamiflu) are active against both Influenza A and B by blocking neuraminidase. DNA polymerase inhibitors (e.g., vidarabine and idoxuridine) are active against Herpes viruses but are ineffective against the influenza viruses (orthomyxoviruses), which have a (-)RNA genome. The target-activated nucleoside analogues (acyclovir and its relatives) are likewise active against the DNA-containing Herpes viruses. Reverse transcriptase inhibitors and protease inhibitors are active against HIV retroviruses, Hepatitis B virus (reverse transcriptase inhibitors) and some (+)RNA viruses (protease inhibitors).
4. The answer is E. A patient over 50 years of age, with a febrile disease associated with a sudden elevation of temperature after a sharp chill, with chest pain, cough productive of blood-tinged sputum, elevated leukocyte count with neutrophilia, and a confirmatory X-ray showing consolidating lobar pneumonia has most likely pneumococcal pneumonia. The X-ray patterns in *Mycoplasma* and *Pneumocystis carinii* pneumonia are very different, showing bilateral interstitial infiltrates and no consolidation. Anaerobic pneumonia is seen in totally different clinical contexts and the chest X ray typically shows lung abscesses with gas. *Klebsiella pneumoniae* pneumonia is often associated with hemoptysis (currant jelly sputum) and the chest X-ray findings include bulging interlobar fissure and cavitary abscesses. *Klebsiella pneumoniae* is also extremely rare as a cause of community-acquired pneumonia in the USA accounting for <1% of cases of pneumonia requiring hospitalization.
5. The answer is B. Levofloxacin is effective against strains both moderately and highly resistant to penicillin, and in case of doubt is one of the drugs of choice (together with two other fluoroquinolones – Gatifloxacin and Moxifloxacin). Vancomycin should not be used to start empiric therapy because of its serious side effects. Sulfamethoxazole-trimethoprim is not recommended for the treatment of streptococcal infections in general.

Elderly Man With Fever and Cough

Answers to the Post-Test (ctd.)

6. The answer is A. Good sputum samples for culture are often difficult to obtain and false negative results are frequent. Blood samples should be sent for culture before antibiotics are started and are more frequently positive because *S. pneumoniae* often causes bacteremia in patients with pneumonia.
7. The answer is A. The principle of respect for autonomous choice by capable individuals in our society permits a person to accept or refuse medical treatments as long as the elements of informed consent (comprehension and understanding of benefits and burdens, absence of coercion) are met. When a patient is incapable of making decisions and if there is no court appointed or legal guardian, the next of kin are considered the appropriate decision-makers for the patient. Decisions should be made by the family based on what the patient would have wanted in this situation (substituted judgment) based on his values and prior expressed wishes, thus 'substituting' his autonomous choice even when he is comatose.
8. The answer is A. The decision to forgo life-sustaining treatment is usually grounded in family values, prognosis, burdens of continued therapy, likelihood of functional recovery, and spiritual beliefs. Given the extremely poor prognosis for recovery to baseline and especially for any improvement in the underlying neurological condition, the immediate family appears to be making their decision using the best interest standard. Removal of life sustaining treatment in this case is not active euthanasia nor is it prohibited by law. In most Western societies, ethical consensus states that both withholding and withdrawing treatments are ethically permissible and morally equal.
9. The answer is D. The clinical features are suggestive of UTI caused by an opportunistic agent. One of the most frequent opportunistic agents associated with UTI acquired after prolonged insertion of a Foley catheter is *Pseudomonas aeruginosa*. The involvement of *P. aeruginosa* is further corroborated by the characteristics of the isolated organism (production of a green pigment, oxidase positivity).
10. The answer is C. Piperacillin is effective against *Pseudomonas*, but is a beta-lactam antibiotic and does not seem indicated in a patient infected with a penicillin-resistant strain. The patient's isolate was susceptible to the four remaining antibiotics, and the choice should be based on lesser toxicity. Chloramphenicol can cause irreversible aplastic anemia. Aminoglycosides are neurotoxic and ototoxic; Vancomycin is ototoxic and nephrotoxic.

Elderly Man With Fever and Cough

COMMENTARY

Clinical Issues:

The patient presented initially with symptoms (fever, aches) that led his physician to investigate the possibility that he had viral influenza. This possibility was ruled out and eventually the clinical picture was clearly one of pneumonia, confirmed by the chest X-ray. The CBC showed a sharp increase in leukocytes, particularly neutrophils and a sputum Gram stain showed Gram-positive diplococci. This was strongly suggestive of pneumococcal pneumonia. Sputum and blood cultures had been requested but the rapid evolution of the pneumonia required that empiric therapy be initiated before the culture results become available. Under those circumstances it was correctly assumed that the strain of *Streptococcus pneumoniae* infecting this patient could be resistant to penicillin. However, being a community-acquired strain, it was highly unlikely that it would also be resistant to a third generation cephalosporin (such as Ceftriaxone). Another alternative was to prescribe Levofloxacin (see below). But the decision to start Vancomycin (a nephrotoxic and ototoxic drug) was ill-advised, particularly considering the fact that the patient was diabetic and had pre-existing renal insufficiency. Also, Vancomycin should be reserved for situations in which it may be the only option (such as sepsis involving methicillin-resistant agents or *Clostridium difficile* infections in patients that cannot tolerate metronidazole). To minimize the possibility of inducing toxic effects the plasma levels (trough) of Vancomycin could have been measured, although the correlation of trough levels with toxicity is not very strong.

After an initial positive response of his pneumonia to antibiotherapy he presented symptoms of deteriorating renal function. Usually the renal toxicity of Vancomycin is reversible as the drug is stopped, but this patient had already pre-existing renal failure and his renal function continued to deteriorate. The decision to stop Vancomycin was also delayed more than necessary. This illustrates one of the more common errors in antibiotic usage - a delay in narrowing the broad coverage of empiric therapy to definitive treatment based on culture and sensitivity results.

Because of decreased urinary output, a Foley catheter was placed and, as is often the case, it caused an infection of the urinary tract. The organism isolated from the urine was one of the *Pseudomonas* species. *Pseudomonas* are usually difficult to treat, they have intrinsic and acquired resistance to multiple antibiotics. An antibiogram was obtained and the chosen antibiotic, Levofloxacin (one of the broad spectrum fluoroquinolone antibiotics, used for the treatment of a variety of infections, including bacterial pneumonias and bacterial urinary tract infections) was a good choice to start therapy, but failed to induce the desired effect and the patient developed bacteremia. At this time the treatment was switched to Piperacillin/Tazobactam, an combination of a semi-synthetic penicillin especially active against *Pseudomonas* and a beta lactamase inhibitor. However, the patient continued to deteriorate, developed septic shock, became anuric and comatose. He continued to deteriorate to the point that life-sustaining measures were required to keep him alive. At this time ethical issues surfaced triggered by the existence of a Living Will stating that the patient would not want to be kept alive by means of cardiopulmonary resuscitation or mechanical ventilation if his chances of recovery were minimal.

Elderly Man With Fever and Cough

Ethical issues:

An approach to the ethical dilemma in this case is to review the medical facts, identify ethical issues and overall goals of treatment, and endeavor to resolve the conflicts. The patient is septic and comatose with multiple organ failure and is unlikely to recover. He and his wife are incapable of decision-making (she has Alzheimer's Disease) so based on the SC Adult Healthcare Consent Act, his surrogates are his two children, who should use the substituted judgment standard (make decisions based on patient's previously expressed wishes and values, NOT their own wishes) and his Living Will to make subsequent decisions. Mr. B's Living Will is a legal document and the health care team is obliged to incorporate it into the treatment care plan. He has stated he does not want CPR or mechanical ventilation if he is dying. The clinicians also know that CPR is medically ineffective at reversing his organ failure and the overall dying process and it would violate their professional integrity to offer this burdensome treatment to the family.

Good clinical practice dictates that every effort should be made to resolve the conflict between the two siblings regarding their father's treatment before proceeding to follow the advance directive. A team meeting with the children should be held to communicate information about their father's condition, his prognosis, and the likelihood of success of CPR. Perspectives of the patient, family and healthcare team can be heard in an effort to resolve conflict and determine overall goals of care. Offering the two children other services, such as a second medical opinion, social work, or pastoral care may help the son come to grips with his father's prognosis and wishes. If efforts at conflict resolution fail, the team may enlist the support of the Ethics Committee, who can help facilitate discussion about ethical issues but does *not* make the decisions. If all efforts to get the son to concur with his father's Living Will and the team's recommendations fail, the Living Will must be upheld and the ventilator withheld allowing the patient to die. This case would have been far more difficult if there was no Living Will: then the wishes of one surrogate conflict with another and this puts the health care team and the Ethics Committee in a dilemma in order to determine which surrogate most clearly is speaking using the Substituted Judgment standard.